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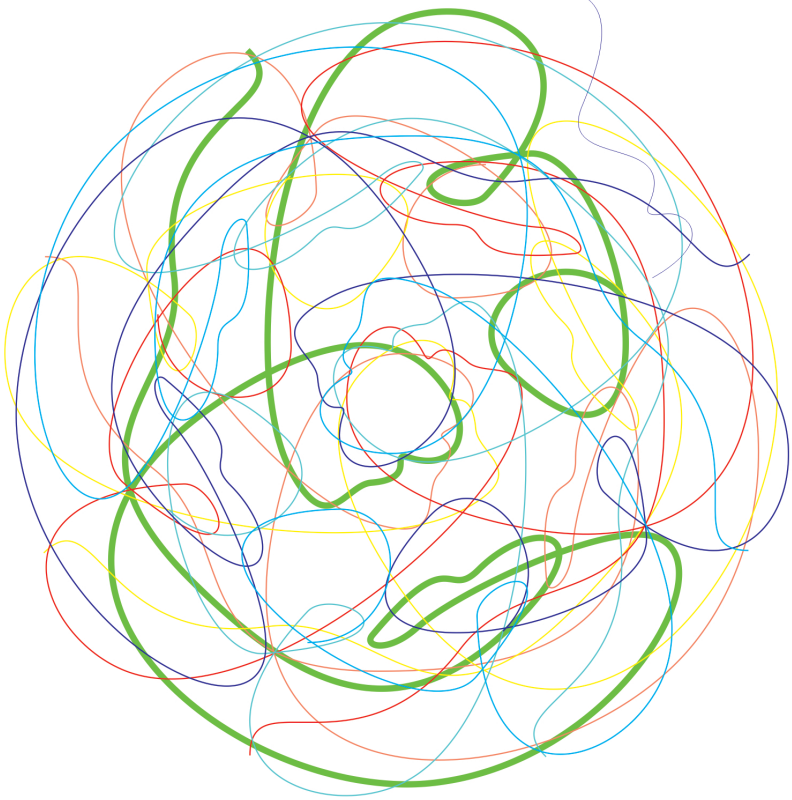
Mindset in learning

A cross-cultural study in China and Finland



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Faculty of Educational Sciences

Helsinki Studies in Education, number 101

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Mindset in learning: A cross-cultural study in China and Finland

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Abstract

The mindset has been one of the most debated topics in educational and psychological setting today, but little is known how the cultural differences are associated with the perceptions and how they are related to individuals' behaviours patterns in a cross-cultural context. This dissertation examines mindsets in learning among Chinese and Finnish students and teachers. It comprises four sub-studies. The theoretical study (Study I) explores the role of mindset in learning among students and teachers by means of synthesising and compiling previous relevant literature. The three empirical studies II, III and IV, which are based on data collected from teachers and students, focus on how mindsets affect patterns of academic behaviour. Study II investigates the ways in which the mindsets of students predict their academic achievement by influencing the factors to which success is attributed. Study III examines the giving of peer feedback among adolescents at school, and how the feedback affects students' mindsets and their academic motivation to learn. Study IV explores the relations between teachers' mindsets and their pedagogical strategies. All three empirical studies adopt a comparatively cross-national perspective, namely comparing Chinese and Finnish participants.

The literature review (Study I) is based on twenty-two articles published between 1998 and 2017 focusing on the association between mindset and academic achievement. The three empirical studies that follow are based on data collected from 1,862 students and 127 teachers in two Chinese and two Finnish state schools. More specifically, Study II, which is based on Dweck's mindset inventory and Weiner's attribution scales, was conducted in one Chinese (N = 705) and two Finnish (N = 495) middle schools. By means of multiple-group structural equation modelling (SEM), Study III investigates the influence of peer feedback on mindsets and academic motivation among fourth-to-ninth-grade students. Finally, Study IV explores the mindsets of selected Chinese and Finnish teachers and their pedagogical strategies from the perspective of praise and goal orientation.

It could be inferred from the literature review (Study I) that students' mindset can function as a cause, a mediator and an outcome related to their academic achievement or mindset is without an evident role, whereas among teachers the mindset functions as a cause and a mediator. Empirical results (Studies II, III, IV) indicate both culture-invariant and culture-dependent features in students' and teachers' mindsets. In line with the culture-invariant results: 1) Majority of the students have a growth mindset, and attribute their academic achievements to both effort and ability, with an emphasis on the former; 2) Person praise given by students to their peers reflects their fixed mindset and negative academic motivation, whereas process-related praise undermines avoidance orientation in academic motivation; 3) Majority of the teachers have a growth mindset. With regard to culture-dependent aspects: 1) Chinese students do not differentiate between the concepts of intelligence and giftedness as clearly as Finnish students do, and their emphasis on effort significantly accounts for higher

language-related grades, whereas Finnish students with fixed mindsets about giftedness achieve higher grades in mathematics; 2) Chinese students prefer to give process-related and person praise, the former reflecting not only their growth mindset but also their positive academic motivation, whereas Finnish students favour neutral praise and have stronger negative academic motivation; 3) Chinese and Finnish teachers differ in their preferred pedagogical strategies even though they have mainly the same growth mindset, such that Finnish teachers utilise growth-mindset pedagogy whereas Chinese teachers seem to apply mixed strategies reflecting both growth and fixed mindsets.

The theoretical review (Study I), which is part of the current study, is the first to explore the role of mindsets in learning, thereby enriching the existing research. The empirical studies (Studies II, III, IV) give constructive suggestions concerning how educators could support the intellectual development and academic growth of learners. Teachers and parents should foster a growth mindset in children and encourage them to value effort and to give process-related feedback to their peers. Thus, it is not enough merely to teach mindset theory at schools. It is equally important to design educational interventions concerning the attribution of performance and giving feedback to peers. The need for education in mindset theory and pedagogical intervention also applies to pre-service and in-service teacher education.

Keywords: Mindset, attribution, academic achievement, pedagogical strategy, praise, academic motivation, students, teachers, comparative study

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Contents

List of original publications

Study I Zhang, J., Kuusisto, E., & Tirri, K. (2017). How teachers' and students' mindsets in learning have been studied: Research findings on mindset and academic achievement. *Psychology, 8*(9), 1363-1377. doi: 10.4236/psych.2017.89089

Study II Zhang, J., Kuusisto E., & Tirri, K. (2019). How do students' mindsets in learning reflect their cultural values and predict academic achievement? *International Journal of Learning, Teaching and Educational Research, 18*(5), 111-126. doi:10.26803/ijlter.18.5.8

Study III Zhang, J., Kuusisto E., Nokelainen P., & Tirri, K. (2020). Peer feedback reflects the mindset and academic motivation of learners. *Frontiers in Psychology, 11*, 1701. doi:10.3389/fpsyg.2020.01701

Study IV Zhang, J., Kuusisto E., & Tirri, K. (2020). Same mindset, different pedagogical strategies: A case study comparing Chinese and Finnish teachers. *International Journal of Learning, Teaching and Educational Research, 19*(2), 248-262. doi:10.26803/ijlter.19.2.15

1 Introduction

One of the most highly debated topics in educational settings today concerns the feasibility of developing human intelligence, namely the mindset, which in recent decades has been identified as an essential factor in explaining learning differences (Dweck et al., 2014; Kuusisto et al., 2017). In particular, through the mediation of social-cognitive approaches, it has the potential to predict numerous aspects of individual performance whether it be academic, cognitive, motivational or affective.

However, despite the amount of existing research on the relations between the mindset and academic well-being, on the theoretical level little is known about its exact role in academic patterns. First, on the empirical level, Dweck's mindset theory is not as concrete and intuitive as Weiner's attribution theory, especially when it comes to examining how mindsets predict performance: it would seem plausible to explore how mindsets predict academic achievement by influencing the factors to which success is attributed. Second, despite the number of previous studies on parents and teachers as feedback givers, and school pupils as feedback recipients, little is known about the extent to which peer feedback among adolescents affects their academic well-being. Moreover, there is a lack of research on how feedback reflects the adolescent mindset and academic motivation simultaneously. It is thus worthwhile investigating the giving of peer feedback among adolescents at school, and how it affects students' academic leanings. Third, the majority of previous mindset-related studies focus on the perspective of students, whereas research on teachers remains relatively scarce. In particular, it would be worth investigating the correlation between the mindsets of teachers and their pedagogical behaviour in terms of both praise and goal orientation.

The aim of this study is thus to shed light on the mindsets of students and teachers in learning. The thesis comprises two parts. The first part is the theoretical literature review (Study I), in which research on the relationship between mindset and academic achievement in learning is compiled and synthesised with a view to enhancing understanding of the role the mindset plays among teachers and students. The second part comprises three empirical studies (Studies II, III and IV) that test the mindset role model and even broaden it by specifying how the mindset affects patterns of academic behaviour. The empirical analyses are based on data gathered from 1,862 students and 127 teachers who participated in the investigation conducted in two Chinese and two Finnish schools offering basic education. More specifically, Study II explores how the mindsets of students in middle school predict their academic achievement by influencing attribution factors, based on Dweck's mindset and Weiner's attribution scales. Study III, which is based on structural equation modelling (SEM), investigates how peer feedback affects the mindset and academic motivation of adolescents at school. Study IV focuses on the relations between teachers' mindsets and their pedagogical strategies, from the perspectives of praise and adaptive learning.

Moreover, the issues addressed in the three above-mentioned empirical studies are discussed in light of the cultural-variant and cultural-invariant nature of China and Finland, respectively. It is a fact that the conception of intelligence is always culture-dependent (Gardner, 1999),

which is why it is essential to study the mindset in academic settings from the perspectives of different cultural values and educational systems.

Both China and Finland have been successful in the Programme for International Student Assessment (PISA, OECD, 2019), despite the different cultural and educational climates. Academic achievement and competition are essential learning-related concerns in China (Ma et al., 2013), which is why most students have additional tutoring to make them higher academic achievers. This is also in accordance with the country's effort-oriented culture (Dweck, 2000; Hofstede et al., 2010; Wang & Ng, 2012). Schools in Finland, on the other hand are designed to be relatively integrative and inclusive learning environments, in which individual holistic development, equal opportunity and high-quality education (Finnish National Agency for Education, 2016) are emphasised over pure academic achievement (Tirri & Kuusisto, 2013). China has also been identified as a high-context culture with a focus on communication style, in which the emphasis is on how the message is delivered (Hall, 1976), whereas in Finland, with its low-context culture, the content of the message is more important than the way it is communicated. Finland favours neutral communication, and this characteristic also fits in well with its status as a neutral country between east and west. Given the cultural and educational differences between China and Finland described above, the present study could be considered cross-national.

The aim is to explore the following research questions:

1) What role do the mindsets of students and teachers play in learning? (Study I)

2) How do the mindsets and attributions of Chinese and Finnish students in learning predict their academic achievements? (Study II)

3) How does peer feedback reflect the mindsets and academic motivation for learning among Chinese and Finnish students? (Study III)

4) What pedagogical strategies do Chinese and Finnish teachers prefer (Study IV)

- from the perspective of goal orientation?
- from the perspective of praise?

2 Mindset in Learning

2.1 Mindsets that enhance learning

The term "mindset", proposed by Carol Dweck (2006), refers to the implicit beliefs individuals hold about the malleability of their basic qualities (Dweck, 2017). People with a fixed mindset believe that human qualities are static (entity theory), and they are inclined to fear challenge and to devalue effort, whereas those with a growth mindset recognise that basic qualities are dynamic (incremental theory), and they tend to embrace challenges and to value effort. The mindset reflects people's understanding of how the brain's plasticity can foster learning. Hence, proponents of incremental theory may attain ever-higher levels of achievement, whereas those who are persuaded by entity theory may achieve less than their full potential (Dweck, 2017).

Numerous reviews of how the mindset of students affects their performance attest to its crucial role in adaptive or maladaptive functioning (Burnette et al., 2013; Dweck, 2017; Tirri & Kujala, 2016; Yeager & Walton, 2011). Dweck and Leggett's (1988) social-cognitive approach to motivation specifies how individuals' implicit theories orient them to setting different goals and influence their behaviour patterns. For example, raising awareness of a growth mindset and supporting such thinking radically enhances academic resilience and achievement (see also Aronson et al., 2002; Blackwell et al., 2007; Yeager et al., 2019). Dweck's (2000) review of her research findings over 30 years shows how people's implicit theories affect not only their self-judgment and performance, but also how they judge and treat others. Burnette et al. (2013), in turn, demonstrate in their quantitative synthesis and meta-analysis of research conducted between 1988 and 2010 that implicit theories predict achievement via self-regulatory processes such as goal-setting and goal-operating. The potential of a growth mindset to enhance the motivation of individuals has been proved at different levels of schooling from primary education (Mueller & Dweck, 1998) to college or university studies (Aronson et al., 2002). Moreover, such enhancement could have a positive effect on academic achievement, whereas a fixed mindset could have a negative effect.

Equally noteworthy is the fact that Dweck's mindset theory has been criticised, specifically with regard to the impact on individual performance. No links were found between incremental beliefs and academic achievement among Greek students at elementary and lower-secondary schools (Leondari & Gialamas, 2002), or among American undergraduates (Robins & Pals, 2002). Moreover, Dupeyrat and Mariné (2005) found nothing to link the mindset of participants with their goal orientation and cognitive engagement in learning in their empirical study conducted among French students.

2.2 Attribution and goal orientation

According to Weiner's (1979, 1985) attributional theory, success and failure could be attributed causally to effort or ability. The term effort normally relates to situations individuals can control, whereas ability refers to fixed qualities. Finnish Olympians tend to attribute their performance to both ability and effort, for instance, but identify effort as slightly more influential on talent development than ability (Tirri, 2001). Research participants from America

and Taiwan of China have also attributed achievement to effort rather than ability (Feng et al., 2001; Wu & Chen, 2001), whereas the German participants placed more emphasis on ability (Heller & Lengfelder, 2000).

A comparison of Dweck's mindset and Weiner's attribution theories reveals some common properties (Hong et al., 1999). Students with growth mindsets are more likely than their counterparts with fixed mindsets to attribute their failure to a lack of effort, and are more inclined to take remedial action, for example. Even though Dweck's theory purports to explicate the cognitive mechanism behind individual behaviours, namely mindsets, it is not sufficiently concrete or intuitive to determine how mindsets predict performance. Hence, it would be worthwhile combining the two approaches to investigate how mindset predicts performance via the attribution process.

Teachers who support the entity theory of intelligence are likely to adopt performance-oriented (Park et al., 2016) and unproductive (Rattan et al., 2012) pedagogical practices, according to which they view themselves as less responsible for their students' academic performance (Patterson et al., 2016; Rissanen et al., 2018). Conversely, followers of incremental theories seem to adopt growth-mindset pedagogy, the key tenets of which include helping students to set mastery-oriented goals and offering process-focused support of the learning process (Rissanen et al., 2019). This, in turn, results in better performance from students. Evidence of such an effect was found in an online growth-mindset-related intervention among lower-achieving students in secondary education (Yeager et al., 2019). However, there are some exceptions. First, regardless of their personal implicit beliefs, highly-educated teachers seem able to adopt a growth-mindset pedagogy. Second, even a highly-educated teacher might fail to teach academically talented students how to cope with setbacks and to tackle learning challenges (Rissanen et al., 2019). Thus, teachers with growth mindsets do not necessarily apply the principles in their teaching practice (Schmidt et al., 2015).

2.3 Feedback in cognitive and academic development

An increasing number of studies have attested to the effect of feedback from parents and teachers on how children perform (Hancock, 2002; Hattie, 2003; Brummelman et al., 2014; Gunderson et al., 2018). The quality of the praise seems to be crucial, given that 'the wrong kind of praise creates self-defeating behaviour while the right kind motives students to learn' (Dweck, 2007, p. 34). Furthermore, praise devoid of substance and honesty is empty, 'because it carries little information … and too often deflects attention from the task' (Hattie & Timperley, 2007, p. 96). Inflated praise may discourage children with low self-esteem from setting challenging goals and engaging in crucial learning activities, for example (Brummelman et al., 2014).

Students who are praised for their intelligence, namely given person praise, appear to avoid challenging tasks and cannot cope with setbacks in their learning (Mueller & Dweck, 1998), which in turn tends to undermine their achievement and feelings of self-worth (Kamins & Dweck, 1999). Process praise, on the other hand, encourages them to take on challenges and to expend more effort (Kamins & Dweck, 1999; Mueller & Dweck, 1998). It also helps children to see human qualities as malleable, namely to develop a growth mindset, whereas person praise encourages them to adopt more fixed views, namely a fixed mindset (Dweck, 2006, 2017;

Mueller & Dweck, 1998; Kamins & Dweck, 1999; Zentall & Morris, 2010; Gunderson et al., 2013). Gunderson and her colleagues found in their longitudinal studies that parental praise of toddlers predicted the development of incremental beliefs five years later (Gunderson et al., 2013), and academic achievement in the fourth grade (Gunderson et al., 2018).

Other feedback styles such as outcome praise, neutral acknowledgement and luck-related judgement have also been shown to enhance cognitive and motivational development. Outcome praise helps individuals who are facing setbacks to avoid negative responses (Kamins & Dweck, 1999). Neutral acknowledgement, in turn, enhances cognitive development and the motivation to learn (Ferrar et al., 2019). Its impact is generally attributed to the positive but mixed (i.e. ego-involved and task-involved) rather than the clear messages (Butler, 1987) it conveys. Even though the precise benefits of these feedback styles are still not clear, previous studies have verified the positive role of neutral feedback, similar to that of process praise. Luck, as an external factor that individuals cannot influence, has been identified as a major determinant of learning performance especially among pupils with a low-socio-economic status (Butler, 1986). Attributions of success to luck seem to reflect 'uncertainty about the causes of performances more than they do a generally fatalistic world view' (Butler, 2000, p. 275).

2.4 The role of teachers' and students' mindsets in learning (Study Ⅰ)

Study I is published as a literature review, exploring the role of mindsets in learning in a compilation and synthesis of mindset-relevant and performance-relevant articles. It addresses two research questions: What is the role of students' mindsets in their academic achievement? What is the role of teachers' mindsets in their students' academic achievement?

2.4.1 The role of students' mindsets in their academic achievement

The mindset as a cause. Thirteen articles support the notion that the mindset of students appears to affect their academic achievement as a causal factor. This causal role is the most common among the roles that mindsets play in individual performance, and it has been identified among students ranging from primary school (Mueller & Dweck, 1998) through secondary school (Blackwell et al., 2007; Claro et al., 2016) to universities and colleges (Aronson et al., 2002). Moreover, the impact on academic achievement is normally mediated through some intermediate variables such as attribution (Claro et al., 2016), goal setting (e.g., performance and mastery goals, see Leondari & Gialamas, 2002), resilience and socioeconomic strata. These observations support Dweck's (2002) argument that "children's competence-related beliefs have their strongest direct effects on performance" (p. 108).

The mindset as a mediator. Two studies thus far have verified the mediating role of the mindset. Claro et al. (2016) found that students from low-income families exhibited high academic achievement because their growth mindsets "appreciably buffered against the deleterious effects of poverty on achievement" (p. 8664). The mindset was found to mediate student autonomy in terms of studying hard, as well as emotional well-being in terms of feelings of depression, for example, and thereby to have a direct impact on academic achievement

(Mouratidis et al., 2017). This is consistent with Butler's (2000) conclusion that the mindset of students mediates "the effects of different kinds of information" (p. 974).

The mindset as an outcome. It was found in a study conducted in Greece (Gonida et al., 2006) that the adoption of a particular mindset among the participants depended on their earlier achievements through the mediation of perceived competence. In general, high achievers were more likely than medium-level and low achievers to entertain incremental beliefs.

The mindset without an evident role. Interestingly, some studies challenge Dweck's theory concerning the impact of mindsets on performance. Dupeyrat and Mariné (2005) found no evidence of an impact on goal orientation or cognitive engagement in learning, and it is specifically pointed out in a Greek study (Leondari & Gialamas, 2002) that "incremental beliefs were not related to academic achievement" (p. 287). One reason for this could be that difference in students' mindsets is indicative of difference in their academic abilities, which did not translate into different levels of achievement (Robins & Pals, 2002).

2.4.2 The role of teachers' mindsets in students' academic achievement

The mindset as a cause. Five articles identify a causal role of their teachers' mindsets in the academic achievement of students. The mindset of teachers has been related to student learning by way of supporting classroom intervention (Schmidt et al., 2015). Indeed, it seems that the positive impact of Brainology intervention on student performance is reinforced and lasts longer among students when the teacher adopts a growth mindset and delivers corresponding pedagogy in the classroom. In contrast, the impact of the intervention does not last, and even weakens, among students whose teachers have a fixed mindset and deliver corresponding messages in their teaching. This result is consistent with findings reported in an earlier study indicating that Brainology intervention initially "encouraged a growth mindset in the pupils, supporting the pre-post results of previous studies" (Donohoe et al., 2012, p. 653), which may relate to the fact that "teacher-given normative feedback is valuable and visible at school and specifically significant to the perceptions of school-aged children" (see Kärkkäinen et al., 2010, p. 569). The normal form of intervention through which teachers stimulate students is the giving of feedback, especially praise. Process praise may have a positive impact on student learning, whereas person praise could have negative effects (Jonsson & Beach, 2012). Moreover, nurturing teachers' mastery goals in teaching is beneficial to the development of a learning environment in which students could achieve maximum learning and intellectual growth (Shim et al., 2013).

The mindset as a mediator. Two studies from Finland, which were limited but nonetheless noteworthy, indicate that the teacher's mindset could mediate the relations between the parental mindset and the child's academic potential. Kärkkäinen and Räty (2010) found a "moderate and positive correlation" between teachers' and parents' ratings of children's potential. In particular, the more optimistic the parents were, the more confident were their children, and thus the greater their assumed academic potential. This result is consistent with findings from earlier research demonstrating a link between the teacher's assessment of the child's potential and the mindset of its mother (Räty et al., 2006).

3 The cultural and educational contexts in China and Finland

3.1 Cultural values and the educational systems

China and Finland represent quite different cultures on Hofstede's cultural dimensions (Hofstede et al., 2010). As **Table 1** indicates, the Chinese culture has been identified as one that is high in power distance, meaning that authorities are respected, but power should be moderated by obligations (Hofstede et al., 2010, p. 80). For example, the Ministry of Education is the highest educational authority, formulating and issuing educational policies including budgetary allocations and educational guidelines, as well as administrating educational institutions (National Centre for Education Development Research & Chinese National Commission for UNESCO, 2008). Equally noteworthy is the gradual decentralisation of educational sectors: some local authorities have been granted the autonomy to choose textbooks and design teaching activities, for instance. Moreover, as a collectivist culture China emphasises patriotism and national pride, resulting in educational policies oriented towards serving the culture and the country. As a consequence, there are ideology-related or politics-related subjects on almost every educational level. The restraint that characterises the Chinese culture is reflected in the emphasis on ethics rather than gratification, as exemplified in the indigenous precept: 'Do not impose on others what you do not desire' (*jǐ suǒ bù yù, wù shī yú rén*).

Gender roles are emotionally distinguished in male-oriented countries such as China, in which women are supposed to be modest, tender and focused mainly on material success whereas men are assertive, tough and focus on career success (Hofstede et al., 2010). Finally, China is generally considered to be long-term focused, which according to Hofstede et al. (2010, p. 239) refers to the fostering of virtues oriented towards future rewards in contrast to the short-term orientation towards the past and the present. Both at home and at school, for example, virtues such as perseverance and thrift are instilled in children to ensure their future well-being. The emphasis on perseverance also supports the finding that Asian cultures are effort-oriented (Dweck, 2000).

Confucianism, as the central component of ancient culture, has played a crucial role in the ethics of every-day life in China and continues to do so. It also reflects the cultural values described above (Qian, 2002; Hofstede et al., 2010, pp. 237-238). Traditional Confucianism emphasises the following: 1) respect for the hierarchy (large power distance); 2) the family as the prototype of society as a whole (collectivism); 3) responsibility to society and ethical norms (restraint); 4) the dominance of males in roles such as ruler, father and husband (masculine feature); 5) patience and perseverance as well as hard working (long-term orientation).

In comparison with China, Finnish culture is identified as low in power distance given that equality has been the prevailing ideology since the 1960s (Räty & Snellman, 1998). Decentralisation in educational practice has been the norm since the 1980s (Tirri & Kuusisto, 2013). Local authorities and schools have most of the decision-making power, for example, and are autonomous in terms of implementing concrete measures on matters such as funding

allocation and curricula design as well as personnel recruitment. It is worth noting that Finnish teachers have the pedagogical freedom to choose textbooks and teaching approaches (Gholami et al., 2015). Thus, it is easy to understand why the curricula in different schools and regions of Finland are flexible.

Individualism has been one of the key principles in Finnish education since the 1990s (Kuusisto et al., 2017). Transversal competences are encouraged to facilitate holistic growth: thinking and learning-to-learn, cultural competence, life-management skills, multiliteracy, ICT competence, working-life skills and civic involvement (Finnish National Agency for Education, 2016). Moreover, as a country with an indulgent culture, Finland takes account of natural human desires related to enjoying life and having fun (Hofstede et al., 2010; Gholami et al., 2015). This cultural approach is reflected on the educational level in the integrative and inclusive learning environments in which learning focuses on both growth and enjoyment (Tirri & Kuusisto, 2013). Both men and women are expected to achieve a relative balance between family life and career development, hence Finland is commonly recognised as high on femininity (Hofstede et al., 2010, p. 140). The Finnish educational and moral ethos derives from its heritage of Lutheran Christianity, based on respecting the past and fulfilling present obligations (Hofstede et al., 2010, p. 269; Gholami et al., 2015). Finland could thus be described as being short-term-oriented.

In terms of educational systems (see Table 2 in Study II for the details), the two countries share similarities but have some apparent differences. The Finnish educational culture is geared to making high-quality education available to everyone and to fostering holistic and individual growth. Teachers are encouraged not to compare students with each other, but rather to evaluate them based on their previous achievement in conformance to Dweck's (2000) ideas about how a growth mindset is supported. However, there appear to be two conflicting phenomena in the Finnish educational system: one supporting equal development and the other acknowledging giftedness as a fixed quality (Kärkkäinen & Räty, 2010; Rissanen et al., 2018). The aim in special education, for instance, is to serve the needs of students with learning difficulties on the assumption that the competences of academically poor students are malleable, whereas there is as yet no special education for academic high-achievers (Kärkkäinen & Räty, 2010; Rissanen et al., 2018; Tirri & Kuusisto, 2013). From this perspective, Finnish schools appear to support both a growth mindset and a fixed mindset. However, following the implementation of the National Core Curriculum for Basic Education 2014 (Finnish National Agency for Education, 2016), time will tell whether this phenomenon will still hold, given that the new curriculum highlights the individual growth of all students including the gifted.

Despite the cultural differences between China and Finland, their respective educational systems share some similarities. They have the same five-level structure, for example: pre-school, primary school, lower-secondary education, upper-secondary education and higher education; funding resources depend mainly on governmental allocation with little involvement of private sponsorship; and basic education is free. However, Finland's policy of free tuition also covers college and university education. All teachers in basic education in China are subject teachers who instruct in one specific subject, whereas class teachers in Finnish primary schools teach all subjects and subject teachers focus on the higher grades.

Table 1. Cultural Values (based on Study Ⅱ and Hofstede et al., 2010)

Dimensions	China		Finland	
	Category	**Example in education**	**Category**	**Example in education**
Power distance	Large	Educational power: Centralised → Decentralised Curriculum: Uniform → Flexible	Small	Educational power: Decentralised Curriculum: Flexible
Individualism–collectivism	Collectivism	Ideology-related subjects	Individualism	Holistic growth & Transversal competence
Indulgence–restraint	Restraint	Emphasis on ethics	Indulgence	Integrative and inclusive learning environments
Masculinity–femininity	Masculinity	---	Femininity	---
Orientation	Long-term	Virtues like patience, perseverance and thrift are instilled for students' future well-being	Short-term	Ethos emphasises respect for the past and the fulfilling of present obligations

3.2 Teacher education in China and Finland

The teaching profession in China can be traced back to Confucian times, as early as BC 500. However, formal teacher education originated in the 1900s (Guo, 2005; Li, 2012, 2013) with the founding of the first teacher-training school, Nanyang Gongxue, in 1897 (see Table 1 in Study III), and developed quickly after the establishment of the People's Republic of China in 1949 (Wen, 1989). The social position of teachers has gradually improved since the first national Teachers' Day in 1985, and their legal rights were guaranteed under the Law of Teachers in 1993. Another major event was the issuing of the "Outline of China's National Plan for Medium and Long-term Education Reform and Development 2010-2020" in 2010, China's first major educational initiative of the 21st century and the principal guideline of educational practice in the current decade.

Specialised universities and colleges have traditionally been the main institutions offering teacher education, although comprehensive universities with separate educational study programmes are increasingly becoming involved (State Council of People's Republic of China, 2010; Li, 2012). The studies of teacher trainees, as future subject teachers, comprise their respective subject and educational science, and include teaching practice. Generally, an associate degree (3 years) is required for elementary-level teachers (State Council of People's Republic of China, 2010), whereas a Bachelor's degree (4 years) is required for those on the secondary level (Li, 2012). Moreover, graduate studies (2-3 years) are mandatory for teachers at secondary schools in economically developed regions (Ministry of Education, 2002; Li, 2012). The main selection criterion for future teachers is their performance in the National College Entrance Examination (*gāo kǎo*). A significant development is the introduction of free education with a living allowance for student teachers at key Chinese national universities specialising in teacher training.

A teaching qualification is compulsory for all prospective teachers in China, which is granted following a written examination, a lecture-based structured interview and language assessment for Mandarin Chinese (Ministry of Education, 2013). Since 2015 teachers have been required to update their teaching qualifications every fifth year, which entails the evaluation of teaching performance and moral behaviour (Ministry of Education, 2013). Enhancing students' holistic growth and encouraging them to adapt to social needs are considered key goals of

educational reform and development, and moral behaviour is the paramount factor in the employment and assessment of teachers (State Council of People's Republic of China, 2010). Measures have been introduced in recent years guaranteeing financial support for promoting the well-being of teaching communities from the national government and local authorities. These include introducing a minimum salary for teachers that is no less than the average salary of the country's civil servants, and offering medical and retirement insurance (State Council of People's Republic of China, 2010).

Finnish teacher education began with the establishment of the first professorial Chair at the University of Helsinki in 1852 and the founding of the first teacher-training seminar in Jyväskylä in 1863. The Teacher Education Act was formulated in 1971: the education of classroom teachers was accordingly reassigned to universities in 1974, and a Master's degree was required for teachers at both elementary and secondary schools (Kansanen, 2003).

Eight comprehensive universities provide teacher education in Finland (Niemi & Jakku-Sihvonen, 2011). The selectin of students for teacher education is based on an entrance test to assess the applicants' basic qualities and an interview to assess their motivation for teaching as well as their social and communicational skills (Kansanen, 2003; Niemi & Jakku-Sihvonen, 2011). Prospective teachers for elementary and secondary schools have to complete a three-year Bachelor's programme and a two-year Master's programme (Bachelor 180 + Master 120 = 300 Credits). Subject teachers begin by studying their respective subjects, and after two years they begin their pedagogical studies. Prospective class teachers, on the other hand, major in educational science, which includes multidisciplinary subjects, cross-curricular themes and pedagogical studies (60 credits, including approximately 20 credits of teaching practice).

Finnish teacher education is research-based, the aim being to enable teachers to think pedagogically and to combine academic research with practical teaching (Tirri, 2014). Thus, prospective teachers are encouraged to make educational decisions based on rational as well as intuitional or everyday argumentation (Kansanen, 2003). Given that the core concern in Finnish education is to provide all citizens with high-quality education, the development of pedagogical thinking, especially regarding equality and autonomy, is considered crucial in the training of teachers (Finnish National Agency for Education, 2016). In practice, teachers have full pedagogical autonomy ranging from textbook choice to teaching approach. On the higher administrative level, municipal authorities and local institutions even have the right to allocate funding and to recruit personnel. Ethical codes for teachers were published in 1998, the aim being to guide the moral behaviour of members of the teaching profession.

In sum, given the long history of the teaching profession in China and the increasing support from the government, teachers are respected in society as a whole, and are widely recognised as role models for students. The emphasis in current Chinese education is twofold, on the professional development of students in a field in which they could prosper in the future, and on holistic growth. Thus, the teacher education focuses on performance and moral behaviour. The Finnish teaching profession is relatively young by comparison, but it has been developing rapidly. Highlights in current Finnish practice include promoting individualistic and holistic growth among students as well as academic achievement (Kuusisto et al., 2017). Thus, teachers are expected to acquire sufficient high-level pedagogical and ethical skills to create an integrative, innovative and inclusive learning environment.

4 Data and methods

4.1 Participants and procedure

As indicated in **Table 2**, 1,862 students and 127 teachers participated in the investigation. They represented two Chinese and two Finnish schools for basic education. The student sample comprised 992 Chinese (46.1% females, M_{age} = 13.2, *SD* = 1.602) and 870 Finnish (49.2% females, M_{age} = 12.6, *SD* = 1.714) individuals, and the teacher sample included 50 Chinese (44.0% females, M_{age} = 32.80, *SD* = 9.602) and 77 Finnish (81.8% females, *M*age = 41.80, *SD* = 11.128) participants. The Chinese schools were located in Sichuan Province and the Finnish schools in the Helsinki metropolitan area. There were more students from secondary schools than from primary schools in both the Chinese (56.4%) and the Finnish (71.0%) samples. Twenty-four of the teachers worked on the elementary level and 26 on the lower-secondary level in the Chinese sample, compared with 40 and 37 teachers, respectively, in Finland. As many as 97.4 per cent of the Finnish teachers had a Master's degree, whereas 54.0 per cent of the Chinese teachers had a Bachelor's degree and the remaining 46.0 per cent an associate degree. On average, the selected Finnish educators were 10 years older than their Chinese counterparts, and accordingly had much more teaching experience (M_{Fin} = 12.34, *SD* = 9.851; M_{Ch} = 9.98, *SD* = 10.467).

Table 2. Participant demographics

	Student		**Teacher**	
	China（N=992）	**Finland**（N=870）	**China**（N=50）	**Finland**（N=77）
Gender				
Female	457 (46.1%)	428 (49.2%)	22 (44.0%)	63 (81.8%)
Male	535 (53.9%)	442 (50.8%)	28 (56.0%)	14 (18.2%)
Age	13.2 (1.602)	12.6 (1.714)	32.80 (9.602)	41.80 (11.128)
School level				
Primary School	332 (43.6%)	252 (29.0%)	24 (48.0%)	40 (52.6%)
Secondary School	560 (56.4%)	618 (71.0%)	26 (52.0%)	36 (47.4%)
Academic achievement				
Mother tongue	7.5(0.832)	8.1 (1.228)		
Mathematics	6.8(0.491)	8.0 (1.490)		
Teaching experience (year)			9.98 (10.467)	12.34 (9.851)
Educational degree				
Associate degree			23 (46.0%)	
Bachelor's			27 (54.0%)	2 (2.6%)
Master's				74 (97.4%)

Consent for participation among the Chinese students was given by the school principals，the students' parents and students themselves. In the case of the Finnish students, permission was granted by the City of Helsinki, the schools' administrative committees, the students'

parents and students themselves. In both countries, consent for the teachers' participation was obtained from the schools' administration and the teachers themselves. In China, the first author was present to explain the details of the research and to distribute the printed versions of the questionnaires. The completed students' questionnaires were collected in each classroom, and those of the teachers were collected from the principal's office. All the Finnish data were gathered via an online questionnaire utilizing Qualtrics software: the students completed the survey during school hours under teacher supervision. The average completion time of teachers' questionnaire was around 20 minutes, and that of students' is 35 minutes. The students' grades were obtained from the respective administration offices in all the schools concerned.

4.2 Measurement instruments

Mindset. Mindset instruments were utilised in Studies II, III and IV. These instruments comprise the implicit theory of intelligence (ITI, Dweck, 2000) and the implicit theory of giftedness (ITG, Dweck 2000; Kuusisto et al., 2017) and measure the malleability of human qualities. Both ITI and ITG include four items rated on a six-point scale (1 = strongly agree, 6 = strongly disagree). Among these scales, values of less than 3.5 indicate a fixed mindset (intelligence or giftedness cannot change, it is fixed), whereas values equal to or above 3.5 indicate a growth mindset (intelligence or giftedness can change, it is malleable). According to a confirmatory factor analysis, the mindset model showed a good fit within a two-factor framework (for the fit index see Article III): *ITI* (e.g., 'You have a certain amount of intelligence, and you really can't do much to change it') and *ITG* (e.g., 'You have a certain amount of giftedness, and you really can't do much to change it').

The Self-Confidence Attitude Attribute Scale (SaaS). The SaaS instrument (Weiner, 1985; Campbell, 1996) was used in Study II. It contains seven items that measure how students explain their achievement on a five-point scale (1 = strongly disagree, 5 = strongly agree) with an emphasis on *effort* (e.g., 'My school achievement would be better if I tried harder') and *ability* (e.g., 'When I do poorly at school, it is because I do not have the necessary ability').

Academic achievement. This instrument was used in Studies II and III. The grades of the Chinese students were based on standardised tests, whereas those of the Finnish students reflected the teacher's assessment of student performance in examinations and daily classroom activities. The testing and assessment were conducted in the autumn of 2017 and the spring of 2018, respectively. To ensure uniformity in this study, the original Chinese grade scale (0 - 100, < 60 = fail, 60 = passing score, 100 = full score) and the partial Finnish grades (0 - 4, 0 = fail, 1 = passable, 4 = excellent) were converted to the common Finnish scale of between four and ten (4 = fail, 5 = passable, 10 = excellent) through data weighting.

Academic motivation. The academic motivation (Campbell et al., 2018) instrument was used in Study III. It consists of 11 items rated on a five-point scale (1 = strongly disagree, 5 = strongly agree) that measure study engagement among students. Both previous empirical evidence and the CFA supported a two-factor structure (for the fit index see Article III): *trying* (e.g. 'I have a strong interest in solving problems') and *avoidance* (e.g. 'Few things taught at school interest me').

Feedback. This instrument was utilised in Studies III and IV. The feedback investigated in this study reflects the concept of praise (Gunderson et al., 2013), including students' praise of

their peers and teachers' praise of their students. On the assumption that their classmates or fellow students achieved exceptional grades in their learning, the participants were asked to assess 16 items of oral praise they preferred to offer on a five-point scale (1 = strongly disagree, 5 = strongly agree). CFA supported three factors in the student sample (for the fit index see Article III): *neutral praise* (e.g., 'Great!'), *person praise* (e.g., 'You are so gifted') and *process praise* (e.g., 'You must have worked hard to achieve this score'). Items indicating luck (e.g., 'You were really lucky!') were also included in person praise (Butler, 1986, 2000). In the teacher sample, to ensure an in-depth and detailed analysis of the teachers' pedagogical strategies, luck was categorised as independent praise.

The Patterns of the Adaptive Learning Scale (PALS). PALS (Midgley et al., 2000) measures the extent to which teachers would like to support their students' performance goal orientation (*PGO*, 'I display the work of the highest achieving students as an example') and mastery goal orientation (*MGO*, 'I give a wide range of assignments, matched to students' needs and skill levels'). The instrument was applied in Study IV, rated on a five-point scale containing nine items (1 = strongly disagree, 5 = strongly agree).

4.3 Statistical analyses

First, the IBM Statistical Package for Social Sciences (SPSS) version 25 was used in the empirical studies (II, III and IV) to estimate the missing values. Among all participants there were none (0.0%, both teachers and students) in the Chinese sample and very few (teachers, 0.5%; students, 1.6%) in the Finnish sample. According to Little's MCAR test, the data were missing completely at random (China: no EM estimated statistics given that there were no missing values; Finnish teachers: $\chi^2(53) = 68.365$, $p = .076$; Finnish students: $\chi^2(32) = 41.010$, $p = .132$).

Second, with regard to Studies II and IV, exploratory factor analysis (EFA) with principal component extraction and direct oblimin rotation (SPSS 25) was carried out to identify the latent factors. The Cronbach's alpha value was calculated to test the internal reliability. Third, given the ordinal variables and the non-normality of the data distribution in the present studies, parametric correlation analysis was conducted among students at lower secondary school (Study II), using Bivariate Pearson correlations to identify the relationships between the variables. On the other hand and given the small sample size (Study IV), the teacher data was subjected to non-parametric correlation analysis with Spearman's Rho (Hauke & Kossowski, 2011).

The second step in Study III after estimating the missing values was to conduct a confirmatory factor analysis (CFA) with R (R Core Team, 2013) across the three separate measurement models: the feedback model, the mindset model and the academic motivation model. After this, the three separate measurement models were combined in a full mediational model, and another CFA was conducted to test the fit indices. The third step was to test measurement invariance (configural, metric and scalar) step-by-step to ensure the psychometric equivalence of the construct factors across the Chinese and the Finnish groups (Putnick & Bornstein, 2016). As Table 1 in Study III shows, metric invariance, namely the factor loadings of the same model across distinct groups, was supported. However, the scalar-invariance test indicated that item-intercept invariance was not supported. Accordingly, it was considered a

suitable option to construct a multi-group mediational model by country in which the factor loadings were set to be invariant.

Fourth, a multiple-group structural equation model was established using the lavaan R package (Rosseel, 2012). The estimation of the mediational model began without control variables, then the students' class degree and maths grades were added as covariates to assess the extent to which these variables affected each factor and the path coefficients. In general, the robust maximum likelihood (MLR) estimator was used in the study because the measurements were ordinal (with no less than five response options) and symmetrically distributed (Raykov, 2012), and full information maximum likelihood (FIML) was used to estimate the missing data.

5 Results

5.1 Students' mindset and attribution predict academic achievement (Study Ⅱ)

To explore 'how students view the nature of the mindset', principal component analyses with direct oblimin rotation for ITI and ITG were conducted among the Chinese and Finnish students separately. The sampling adequacy proved to be meritorious regarding the Kaiser Meyer-Olkin level (KMO = .870 - .879) and the determinant value (Determinant = .084 - .002). The Chinese and the Finnish sample appeared as a one-factor and two-factor structure (α = .838 - .927), respectively. In other words, the Chinese students did not distinguish between the conceptions of intelligence and giftedness, whereas the Finnish students did. They all appeared to have a growth mindset. Paired-sample t-tests showed that both the Chinese and the Finnish students rated the nature of intelligence as more malleable than giftedness. Independent samples t-test also indicated that the Chinese students (M = 3.98, SD = 1.03) rated giftedness as more changeable than the Finnish students did (M = 3.61, SD = 1.37).

Principal component analyses were conducted to address the question, 'To what do students attribute their academic achievements?' Kaiser Meyer-Olkin and determinant (KMO = .721 - .826, determinant = .101 - .398) attested to the sample adequacy. The scree plot and eigenvalue results supported two factors of attribution in both samples, namely effort and ability. The alpha values varied from .573 to .825, indicating poor-but-still acceptable to good reliability. According to the descriptive average scores and paired sample t-tests, both the Chinese and the Finnish students attributed their school achievements more strongly to effort than to ability. Moreover, the Chinese students showed significantly higher effort attribution (M = 4.02, SD = .585), but lower ability attribution (M = 2.22, SD = .805) than the Finnish students (M_{effort} = 3.67, SD = .873; $M_{ability}$ = 2.98, SD = .857).

The first step in addressing the question 'How do students' mindsets and their attributions of success predict their academic achievement?' was to conduct Bivariate Pearson correlation analyses. Statistically significant ($p < .01$) but not very high correlations ($r = 0.163 - 0.283$) verified that a subsequent regression analysis was possible (Chen, 2014), hence a regression analysis based on the Enter method was conducted in the respective samples. Among all students, having a growth mindset with regard to intelligence predicted higher marks in mother-tongue studies ($\beta = 0.161 - 0.240$, $p < .01$), and the tendency of ability attribution predicted lower marks in the mother tongue and mathematics ($-0.245 < \beta < -0.144$, $p < .001$). In contrast, effort attribution alone significantly accounted for higher language marks ($\beta = 0.141$, $p < .001$) among the Chinese students, whereas among the Finnish students a fixed mindset about giftedness ($\beta = -0.140$, $p < .01$) predicted higher marks in mathematics.

5.2 Peer feedback reflects the mindset and academic motivation of learners (Study Ⅲ)

In terms of praise, the Chinese students tended to be more process- and person-oriented, whereas the Finnish students were more neutral (see the Appendix in Study III). With regard to mindset, the mean scores on all eight items were equal to or above the average value of 3.5 (M = 3.5 - 4.2, $p < .001$), indicating the favouring of a growth over a fixed mindset among all participants. However, the Chinese students had statistically higher average scores on items ITG3 and ITG4 (M = 3.6 - 4.2, $p < .001$) than the Finnish students achieved, indicating that they had more malleable views on the developmental potential of giftedness. There was a stronger tendency towards avoidance-oriented academic motivation among the Finnish students.

A multi-group mediational model was established, with the country as the group classification: the fit indices (CFI, TLI > .9, RMSEA, SRMR < .05) were acceptable. In terms of mindset, person praise was negatively related to implicit theories of intelligence and giftedness ($-0.476 < \beta < -0.287$, $p < .019$) in both samples. However, a growth mindset regarding intelligence and giftedness (β = 0.240 - 0.202, $p < .01$) was reflected in process-related praise among the Chinese students, and in neutral praise among the Finnish students.

Across both samples, the higher the usage of process praise, the lower the likelihood of avoidance-oriented academic motivation ($\beta_{Ch} = -0.49$, $\beta_{Fin} = -0.60$, $p < .001$). Furthermore, person praise positively reflected avoidance-oriented motivation (β = 0.54 - 0.72, $p < .001$). Among the Chinese students, neutral praise was found to weaken avoidance-oriented motivation ($\beta = 0.25$, $p = .043$). In addition, process praise was found to enhance trying-oriented motivation ($\beta = 0.45$, $p = .001$), which was not specified in the Finnish sample.

5.3 The same mindset, different pedagogical strategies (Study Ⅳ)

Among the Chinese teachers, the overall response tendency on all the items concerning intelligence and giftedness (M = 4.34 - 4.02) was above the average value of 3.5, demonstrating a growth mindset among Chinese teachers, statistically confirmed in a one-sample t-test. A paired-sample t-test similarly confirmed that the Chinese teachers rated intelligence as more malleable than giftedness ($p < .01$). The Finnish teachers similarly had a growth mindset, and also considered intelligence more malleable than giftedness.

Among the Chinese teachers, the mean scores for PGO and MGO (M = 4.08 - 4.11) were above 3.0, indicating that their teaching strategies tended to relate to both. Furthermore, both PGO and MGO featured more strongly than among their Finnish peers ($p < .05$). The Finnish teachers, on the other hand, adopted mastery-goal (M = 3.85, SD = .821) but not performance-goal (M = 2.49, SD = .762) orientation. A paired sample t-test ($p < .001$) confirmed the stronger tendency towards MGO.

The Chinese teachers seemed to vary their praising style to include process, neutral and person praise (M = 3.52 - 4.13), with average scores above three for each (excluding luck-related praise). In contrast, the Finnish teachers were more likely to adopt process (M = 3.65, SD = .894) and neutral (M = 3.65, SD = .706) praise, and unlikely to give person or luck-related

praise (M = 1.47 - 1.94). Moreover, both the Chinese and the Finnish teachers gave more process than person praise ($p < .001$). Interestingly, the Chinese teachers considered themselves more likely to give process ($p < .01$) praise than their Finnish peers did.

However, Spearman correlation analysis produced no evidence of a correlation between the Chinese teachers' mindset and their perceptions of pedagogical practices. On the other hand, the more strongly the Finnish teachers exhibited a growth mindset about intelligence, the less likely they were to utilise PGO teaching strategies.

6 Discussion

6.1 A summary of Studies Ⅰ, Ⅱ, Ⅲ and Ⅳ

The main purpose of the present study was to investigate the mindsets in learning among students and teachers, and to identify the culture-dependent and culture-invariant aspects by comparing Chinese and Finnish participants. The following research questions were addressed: 1) What role do the mindsets of students and teachers play in learning? 2) How do mindsets and attributions of students in China and Finland predict their academic achievements? 3) How does peer feedback reflect the mindsets and academic motivation for learning among Chinese and Finnish students? 4) What pedagogical strategies do teachers prefer from the perspectives of praise and goal orientation? These research questions are discussed in the four original publications. Study I comprises the theoretical review, outlining the role of mindsets in academic achievement. Building on the theoretical model, Studies II and III examine empirically how students' mindsets affect academic well-being and are affected by academic behaviours. Study IV discusses how the mindset of teachers reflect their pedagogical practices.

The results of Study I imply that the mindsets of students and teachers play causal and mediating roles in academic achievement, of which the student mindset could be a consequence. However, some studies report no relationship between mindset and achievement among students. Study II illustrates similar tendencies with regard to how mindset and attribution predict academic achievement among Chinese and Finnish students: a growth mindset about intelligence and less ability attribution predicted higher marks in learning. This study supported the causal role of the students' mindset in predicting academic achievement reported in Study I. The focus in Study III was on the paths through which student feedback reflects mindsets and academic motivation: the more the students bestowed person praise, the more likely they were to have a fixed mindset and negative academic motivation, indicating a lack of willingness to expend effort on learning. On the other hand, those whose praise was more process-focused were less likely to show negative academic motivation. This finding that a mindset could be predicted from the form of praise students give is in line with the result-oriented role of the students' mindset identified in Study I. Moreover, the lack of significance in the relationship between the students' mindset and their academic motivation justifies the criticism that Dweck's mindset theory has received (Leondari & Gialamas, 2002; Robins & Pals, 2002; Dupeyrat & Mariné, 2005), namely the lack of an evident role of the mindset in learning as reported in Study I. On the other hand, its mediating role reported in Study I was not proved in Study III, which could be attributable to the limited sample size, because when the first author combined the Chinese and Finnish students as a sample and established the SEM, the path from mindset to academic motivation was significant. Study IV revealed no statistically significant relation between mindset and pedagogical strategies among the Chinese teachers. Among the Finnish teachers, a mindset about intelligence was negatively associated with a preference for performance goal orientation, implying its correlation with a fixed mindset. This verifies the causal role of the teacher's mindset identified in Study I.

Equally noteworthy as the paths linking mindsets with academic behavioural patterns described above is the culture-invariant nature of a mindset. For example, both Chinese and Finnish students favoured a growth mindset, and viewed the nature of intelligence as more malleable than giftedness. This result was in accordance with earlier findings on Finnish (Kuusisto et al., 2017) and American (Makel et al., 2015) students. Chinese students even considered the developmental potential of giftedness more malleable than Finnish students did. Moreover, all the students placed more emphasis on effort in attributing academic achievement.

However, there are also some culture-dependent aspects in the different samples. Finnish students differentiated the conceptions of intelligence and giftedness more clearly than the Chinese students did, and held a slightly higher ability attribution. One reason for this could be that Finland is a short-term-orientation country in which students tend to show a talent for theoretical and abstract sciences and attribute success and failure to luck (Hofstede et al., 2010). Finnish students also showed a preference for bestowing neutral praise, which fits in well with the notion of Finland as a neutral country with a neutral communication style. The Finnish students reported more avoidance-oriented academic motivation, which is reflected in the latest PISA studies, Finland having lost its top position in the rankings (OECD, 2019). The neutral praise favoured by Finnish adolescents rather reflected their growth mindset, but was not associated with academic motivation. This is in accordance with previous findings indicating that neutral feedback, similar to process praise, has the potential to promote cognitive development in learning (Ferrar et al., 2019). However, the lack of an association between praising and positive academic motivation implies that the notion of a process orientation proposed in the National Core Curriculum for Basic Education 2014 (Finnish National Agency for Education, 2016) is not yet operational in Finnish schools.

By way of contrast, the Chinese students placed more emphasis on effort, and their effort attribution was significantly related to higher marks in subjects such as the mother tongue and mathematics. Their focus on effort aligns with perceptions of certain Asian cultures as effort-oriented (Dweck, 2000; Hofstede et al., 2010). Common sayings in China illustrate the emphasis on hard work, such as: 'Making an effort to compensate for inadequate intelligence' (*qín néng bǔ zhuō*). This also explains why Chinese students were apt to bestow process praise on their peers, and those who showed such a preference were more likely to have a growth mindset and to exhibit positive academic motivation. The Chinese students also tended to bestow person praise, corresponding to the indigenous precept among the Chinese: 'Man proposes, God disposes' (*móu shì zài rén, chéng shì zài tiān*), indicating power that is beyond one's personal control. Thus, the mixed praising style of Chinese students is in accord with mixed Chinese philosophy emphasising both effort and luck, or to be more precise, destiny.

Interestingly, the mixed behavioural pattern of Chinese students in their learning also reflects the practices of Chinese teachers: they appear to prefer mixed pedagogical strategies supporting both performance and mastery goal orientations, and to use diverse and even contradictory praising styles: process, person and neutral. However, whether the mixed learning behaviour of Chinese students and the mixed pedagogical strategies of Chinese teachers are related to the mixed emphasis of current educational policy in China is an open question. More in-depth analysis is therefore needed. On the other hand, the pedagogical strategies of the Finnish teachers seemed to align with Dweck's theory (2006) and with growth-mindset pedagogy (Rissanen et al., 2019), tending to support a mastery goal orientation among students

and emphasising process and neutral messages. Whether the different praising patterns of Chinese and Finnish educators are related to the different categories of teachers (subject or class teacher) is another open question. Overall, Chinese and Finnish teachers seem to adopt different, even opposing pedagogical strategies despite exhibiting the same growth mindset.

6.2 Validity and limitations

The instruments employed in the present study have been used in previous Finnish and American research (on mindsets, see Kuusisto et al., 2017; on SaaS, see Campbell, 1996; on academic motivation, see Campbell et al., 2018; on feedback, see Gunderson et al., 2013; on PALS, see Midgley et al., 2000), and could therefore be considered valid in terms of measuring what they are supposed to measure (Cohen et al., 2011). The original questionnaires were in English. The first author, a native speaker of Chinese, translated it into Chinese, and the second author, a native speaker of Finnish, translated it into Finnish. To improve the accuracy of the translations, we invited another native speaker of Chinese and another native speaker of Finnish to check them, after which we revised them accordingly. Moreover, on the understanding that some of instruments may not have been used in a Chinese setting before, we carried out a small pilot study among Chinese teenagers (N = 5) based on the Qualtrics online questionnaire. The teenagers were asked to tell the first author if there were any questionnaire items they did not understand or that they found confusing. According to the results, the Chinese questionnaire was understandable. In addition, the first author was present in each class to introduce the research and to answer participants' questions to ensure that they understood all the items.

The literature review (Study I) has some limitations. First, it only covers research focusing on both mindsets and academic achievement, omitting studies that address a single scaling issue. Second, contributions written in a language other than English were excluded, as a result of which we may have missed valuable research reported in other languages. Third, the measure of academic achievement in the study is not strictly based on grades, which may lead to ambiguity or the non-normalisation of academic achievement.

There are also limitations regarding the empirical investigation (Studies II, III, IV). First, the case study was carried out in only four schools in China and Finland offering basic education, thus it cannot be generalised to all Chinese and Finnish students and teachers. Moreover, given that the samples are limited to Chinese and Finnish schools, any generalisation of the results to other cultures would be somewhat limited. Second, the sample was educationally imbalanced in that the selected Chinese schools were located in a rural area and did not correspond academically to the selected Finnish schools in metropolitan areas. The results might have been different had the samples represented equivalent locations. Third, to complement the present horizontal investigation conducted at a single time point, a longitudinal study would serve to elucidate the interconnected differences and relationships among the scaling factors. For example, interventions would be ideal to determine the extent to which a changed mindset affects academic factors from a long-term perspective. In particular, the cross-sectional data limits any interpretation of the mediational model. Fourth, with regard to the multiple-group mediational model, the different scales used in the study contained different numbers of items, which could have led to inaccuracy in the correlates and in the aggregation of the relevant factors (Ketonen et al., 2018). Moreover, the data was largely self-reported,

which could cause measurement discrepancies from real-situational results (Hietajärvi et al., 2019). Therefore, additional data sources such as parental evaluations would supplement the findings. Fifth, given the relatively small sample of teachers, the present study failed to test the potential effects of background variables such as educational level and length of teaching experience on pedagogical strategies. Moreover, the different cultural backgrounds may have resulted in aggregation bias related to individual heterogeneity. Thus, it would be useful in future research to increase the sample size and to deepen any analysis of the direct or indirect impact of the teachers' background variables.

6.3 Implications

On the theoretical level, the literature review (Study I) is the first study explicitly to explore the role of students' and teachers' mindsets in academic settings as causal, mediational or outcome-related, or even as non-evident. It enriches the current research on mindsets from the perspective of role-playing in learning. Whereas abundant studies focus merely on the function of students' mindsets in learning, the present study also considers the mindsets of teachers. Thus, it offers researchers and teachers valuable resources for examining the pedagogical thinking and classroom interaction that support students' intellectual development and academic growth. The following three studies (II, III and IV) test the reliability and validity of the mindset-role model in school settings, and even take it further by investigating the processes that affect it and introducing mindset–related theories other than the one developed by Dweck (2006). In Study II, for example, Dweck's mindset theory and Weiner's attribution theory (1979, 1985) are used in combination to explore how mindset predicts academic achievement by influencing individuals' attribution factors. Moreover, all three empirical studies, which were conducted in two countries that differ in terms of cultural values and educational features, investigated the culture-invariant and culture-dependent nature of mindsets, among other relevant issues. This cross-national, comparative research extends current understanding of intellectual growth and learning development.

On the practical level, the three empirical investigations, which explored the processes linking mindsets with academic scales, report informative results and give constructive suggestions to educational researchers and participants. It is worthwhile for teachers to cultivate a growth mindset among students and encourage them to value efforts to improve their performance at school. In promoting a growth mindset in terms of learning and high academic motivation, parents and teachers should encourage students to give process feedback to their peers. Schools should include courses offering guidance to students in giving constructive peer feedback, so that they understand how process feedback promotes academic motivation. Teacher education should also include relevant training to raise awareness among prospective teachers of the value of peer feedback. Thus, it is not enough merely to teach mindset theory in schools and teacher-education institutions. The implementation of growth-mindset pedagogy (Rissanen et al., 2019) requires educational interventions in which students learn how to offer peer feedback that enhances intellectual growth and learning motivation. Given that teachers with the same growth mindset might adopt different pedagogical strategies, it is necessary to educate prospective and in-service teachers in selecting appropriate strategies such as growth-mindset pedagogy.

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Studies I - IV

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